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Seeking blue futures: Can aquaculture take a leading role on island nations?

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By Bonnie Waycott

Farmed tilapia and rock oysters could address food security, unemployment and more in Tahiti and Timor-Leste



On island nations like Tahiti and Timor-Leste, tilapia and rock oyster aquaculture is positioned to address food security, unemployment and more. Pictured, Cawthron Institute researchers work on oyster triploidization to boost growth rates. Photo by Julien Vignier.

On the islands and atolls of French Polynesia, black pearls have been cultivated from the black-lipped oyster (*Pinctada margaritifera*) since the 1960s. These pearls, renowned for their beauty and uniqueness, are French Polynesia's second-largest source of income, creating jobs and generating national wealth.

However, pearl oyster production has been exposed to several environmental changes and mortality events over the years. At the same time, French Polynesian food is heavily influenced by the natural abundance of seafood, and the Polynesians are particularly fond of oysters.

Against this backdrop, scientists in the town of Vairao in Tahiti have been investigating the possibility of farming other species of oysters, namely the tropical rock oysters *Saccostrea echinata* and *Saccostrea cucullata*. In the 1960s, the first attempts to do this were made by collecting spat from the wild and growing them to maturity. A series of hatchery trials and grow-out tests followed in the 1970s and 1980s but were unsuccessful as farms were hit hard by the parasitic worm *Polydora sp.*, which burrowed into the oyster shells, making them unfit for sale. As a result, all farming trials were abandoned in the mid-1980s.

The French Polynesian environment is also a challenge.

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“It’s oligotrophic and poor in nutrients, so species like the tropical rock oyster grow slowly,” Guillaume Mitta, professor and researcher at the French national institute for ocean science and technology (**IFREMER** (<https://en.ifremer.fr>)), told the *Advocate*. “This species also tends to reproduce very early, so its growth can be compromised.”

Mitta and his team are part of a group of scientists from Australia, New Zealand and New Caledonia who are working on two research programs – the Ostreapol and Ostreapac projects – to establish land-based tropical rock oyster farming in Tahiti. Working with two species from the *Saccostrea* genus, the team is also looking at the use of a technique called triploidization, which, if successful, would be a world-first for tropical rock oysters. The work stems from the World Aquaculture Congress, which was held in Darwin in May 2023, and included a workshop on tropical rock oyster farming.

“Triploidization takes place in the first hour of development, just after fertilization,” said Dr. Julien Vignier, aquaculture researcher at the **Cawthron Institute** (<https://www.cawthron.org.nz>) in New Zealand. “It is widely used in agriculture to produce higher quality, seedless crops, such as bananas, watermelon or grapes. In oysters, early sexual maturity hinders their growth and makes them milky, but if they can no longer produce gametes, this milky phase can be avoided and they can channel their energy into growing faster instead. The result is that they will arrive on tables more quickly and be good to eat year round. So far, we have had very promising results, which is encouraging for the development of Tahitian oyster farming.”



The French Polynesian environment is a challenge for growing oysters, as it is “oligotrophic and poor in nutrients, so species like the tropical rock oyster grow slowly,” according to Guillaume Mitta, professor and researcher at IFREMER. Photos courtesy of IFREMER.

One challenge faced by French Polynesia, as well as other tropical regions and islands across the South Pacific, is the difficulty of acquiring economic and food independence. Each year, French Polynesia imports around 120 metric tons of Pacific oysters (*Crassostrea gigas*) from France and New Zealand, said Vignier, but this generates a significant carbon footprint. The Ostreapol and Ostreapac

projects are aiming to establish oyster farming for local consumption, to provide communities with a steady food supply. Climate change impacts and unemployment are other hurdles, but hopes are high that oyster farming can address these and improve community resilience.

Farming oysters also has other benefits, said Mitta.

“They have a low environmental footprint and are full of nutrients compared to other food sources,” he said. “The demand for oyster farming is also rising around the world. But despite good potential for development in more tropical areas, it is almost exclusively carried out in temperate latitudes. Efforts to produce oysters locally in Tahiti are particularly welcome, because they are a popular delicacy and the island needs to reduce air transport from France or New Zealand, because that has huge knock-on environmental effects.”

“Oysters have bioremediation capacities, while farming them brings other possibilities,” added Cristián Monaco, a researcher at IFREMER. “For example, by co-culturing oysters and shrimp in land-based systems, we can prevent organic waste from leaking into the environment. We can also use the effluents from shrimp aquaculture to generate blooms of single-celled algae that can feed the oysters. This limits the escape of large quantities of nutrients that can destabilize tropical-reef ecosystems and environments like lagoons.”

Vignier agrees, adding that farming oysters on land avoids Tahiti’s subtidal environments, which have very little tides and water flow, and can make oysters more susceptible to *Polydora sp.* infestations. To combat this parasite, the team is also testing a grow-out system that exposes oysters to the air and simulates tide cycles. This innovative, nature-based solution has been possible through a collaboration with local and French private partners.

The team is also fine tuning the domestication process from spawning and fertilization to larval rearing, settlement and grow-out systems, while working on hatchery development, selective breeding techniques, monitoring programs and genetic research. Information is shared regularly with French Polynesian government departments (Direction of Marine Resources, or DRM), and the Polynesians, who are eager to taste the first farmed oysters from Tahiti. If all goes well, these could be on Tahitian plates by the end of 2026.

Like French Polynesia, Timor-Leste in southeast Asia is exposed to the impacts of climate change and dependent on imported food. Now, however, a national strategy to grow Genetically Improved Farmed Tilapia (GIFT) is working to improve food and nutrition security and diversify livelihoods.

Through the **Timor-Leste National Aquaculture Development Strategy** (<https://faolex.fao.org/docs/pdf/tim150788.pdf>) (2012–2030), the government is working with international research organization **WorldFish** (<https://worldfishcenter.org>), and other stakeholders to develop a scalable aquaculture model that focuses on increasing fish availability, accessibility and consumption. Key initiatives include broodstock management systems, establishing GIFT hatcheries, and ensuring that farmers have access to fish market operators, feed importers and more.



Researchers are testing new oyster production systems that expose oysters to the air and simulate tide cycles. Photo by Julien Vignier.



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“Tilapia farming has become a lucrative income-generating activity and farmers are benefiting significantly,” said Dr. Jharendu Pant, senior scientist at WorldFish. “The model has provided employment opportunities along the value chain, while farmers and their families are consuming more fish, directly contributing to improved food and nutrition security in many households.”

The GIFT model has been widely commended in Timor-Leste and beyond, including in several Pacific island nations. In 2018 and 2019, senior government officials from the Solomon Islands and Fiji visited Timor-Leste and participated in hands-on training in tilapia hatchery and grow-out systems. Efforts are now underway to scale Timor-Leste’s model in these countries.

Although the GIFT model is well-developed, there is potential to farm other species, such as bivalves and rock oysters in Timor-Leste, said Pant, who is encouraged by the potential implications of land-based oyster farming in Tahiti.

“It’s likely to be a promising initiative that can help with import substitution, create livelihood opportunities, and contribute to the local economy,” he said. “However, a holistic approach is needed to assess its suitability, taking into account biophysical, ecological and socioeconomic factors before introducing and scaling. A systematically designed pilot project would be beneficial in this regard.”

Back in Tahiti, the research team, too, expect many positive ramifications.

“Employment is one, while another is the story surrounding the blue economy,” said Vignier. “Shellfish are also a low-impact food that are rich in protein and they can clean water. In future, it may also be possible to build oyster reefs in low-lying communities. This could be successful if native species are used and it’s well managed.”

“IFREMER and DRM have been heavily involved in tropical aquaculture developments in Tahiti for over 50 years,” said Monaco. “We have contributed to shrimp farming, fish farming and pearl farming in this territory with spin-offs in the south Pacific and elsewhere in the world. We are confident in the advantages of oyster farming, especially so with triploidization, which will significantly optimize oyster growth.”

Following the first international tropical rock oyster workshop in 2023, a second is due to take place in Tahiti in late 2025. With encouraging feedback from Tahitian communities, Mitta believes that the future of oyster farming on the island is bright, provided it meets environmental and community needs. French Polynesia is not immune to rapidly changing environments, he said, and the production of climate-resilient native rock oysters is a priority for establishing a sustainable sector.

“Addressing biosecurity risks and using locally adapted broodstock are two keys to a successful native oyster farming sector in Tahiti,” he said. “Cost is also important. It’s one thing to introduce expensive farming systems, but they must be adapted to what is available in the environment. What’s also unique to Tahiti is the incorporation of indigenous knowledge in farming practices.”

The holistic approach adopted by the Ostreapol and Ostreapac projects – from genetics, disease and parasite control to hatchery and grow-out developments – could be a blueprint for other island nations in the region, where food autonomy based on food sources with a low environmental footprint, is critical.

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Correspondent Bonnie Waycott became interested in marine life after learning to snorkel on the Sea of Japan coast near her mother’s hometown. She specializes in aquaculture and fisheries with a particular focus on Japan, and has a keen interest in Tohoku’s aquaculture recovery following the 2011 Great East Japan Earthquake and Tsunami.

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